FPIN's Clinical Inquiries

Infectious Etiologies of Acute Otitis Media

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Clinical Question

What is the rate of bacterial versus viral otitis media?

Evidence-Based Answer

There is no preferred method for establishing the infectious etiology of acute otitis media (AOM). Bacterial or viral pathogens are found in most cases. Bacterial pathogens are more common than viruses in middle ear fluid samples collected from children with AOM and intact tympanic membranes. Studies using newer detection methods reveal more viral pathogens than those using less sensitive methods.

Evidence Summary

In a prospective case series, investigators collected nasal washings and middle ear fluid by needle tympanocentesis from 456 U.S. children two months to seven years of age who had been diagnosed with AOM but had not yet received antibiotic therapy.[1] Inclusion criteria were fever, irritability, earache, and signs of tympanic membrane inflammation. The investigators initially performed bacterial cultures of all samples using blood agar, chocolate agar, and MacConkey agar, plus meat broth. They then performed viral culture and indirect fluorescence antibody assays for multiple specific respiratory viruses; middle ear fluid was recollected and tested after two to five days of antibiotic therapy. Bacterial pathogens were isolated in more specimens than were viruses *(Table 1*[1-4]*)*. This study was limited by older, less sensitive methods of viral detection.[1]

In a more recent prospective case series, investigators performed tympanocentesis on 120 Turkish children six months to 12 years of age.[2] All children had been diagnosed with AOM based on the presence of middle ear fluid and at least two local signs (e.g., erythema, fullness, loss of tympanic membrane landmarks, acute perforation with purulent otorrhea). Investigators cultured for bacteria using sheep blood agar, eosin-methylene blue agar, Sabouraud dextrose agar, and thioglycolate broth. Investigators performed reverse transcriptase polymerase chain reaction (PCR) testing to detect viruses. Fluid samples showed a bacterial predominance. The study was limited by use of a single viral detection method.

In a prospective case series of 92 Finnish children three months to seven years of age, researchers collected middle ear fluid samples by tympanocentesis.[3] Physicians diagnosed AOM based on pneumatic otoscopic findings behind an inflamed tympanic membrane and at least one of the following: otalgia, tugging or rubbing of the ear, fever, irritability, restless sleep, vomiting or diarrhea, or simultaneous respiratory infection. Microbiologists cultured the samples for bacteria using standard laboratory methods and performed reverse transcriptase PCR testing for virus detection. They detected a higher prevalence of bacterial versus viral pathogens.

In a fourth prospective case series, investigators evaluated middle ear fluid collected from 79 Scandinavian children seven to 71 months of age who had tympanostomy tubes.[4] Patients had otorrhea less than 48 hours before entry into the study. Investigators collected samples by sterile middle ear aspiration under direct otoscopic visualization before initiation of therapy, and sent the samples for bacterial multiplex PCR testing, culture in blood agar and chocolate agar, viral

Table 1. Prevalence of Bacterial and Viral Pathogens in Middle Ear Fluid Samples from Children with Acute Otitis Media

Type of study	*Number of children*	*Bacteria present (%)*	*Virus present (%)*	*Bacteria and virus present (%)*	*No pathogen present (%)*
Prospective case series[1]	456	63	9	5	33
Prospective case series[2]	120	55	26	6	20
Prospective case series[3]	92	62	22	27	16
Prospective case series[4]	79	92	4	66	4

NOTE: *Some percentages do not total 100 percent because some patients were included in more than one category.*

Information from references 1 through 4.

PCR testing, viral culture, and viral antigen detection through fluoroimmunoassay. They found high rates of both bacterial and viral pathogens. However, results may have been confounded by chronic otitis media pathogens because the samples were taken from children with tympanostomy tubes.

Recommendations from Others

Clinical practice guidelines from the American Academy of Pediatrics and the American Academy of Family Physicians do not specify whether bacterial or viral pathogens are more common in children with AOM. They do note that in middle ear fluid without bacteria, 5 to 22 percent of cases are viral and may have a role in apparent antibacterial failure. No bacterial or viral pathogens can be detected in 16 to 25 percent of patients with AOM.[5]

The American Academy of Pediatrics states that a diagnosis of AOM requires the following: (1) recent, usually abrupt, onset of signs and symptoms of middle ear inflammation and middle ear fluid; (2) the presence of middle ear fluid as indicated by bulging of the tympanic membrane, limited or absent mobility of the tympanic membrane, air-fluid level behind the tympanic membrane, or otorrhea; and (3) signs or symptoms of middle ear inflammation as indicated by distinct erythema of the tympanic membrane or distinct otalgia (discomfort clearly referable to the ear that results in interference with or precludes normal activity or sleep).[5]

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